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EXAMINER	
CHUNG, EUN HEE	
ART UNIT	**PAPER NUMBER**
2123	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	01/16/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No. 10/736,846	Applicant(s) KUSUNOKI ET AL.	
	Examiner Eun H. Chung	Art Unit 2123	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *17 December 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-46* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-46* is/are rejected.

7)☒ Claim(s) *1,4,7,10,15,24 and 35* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *17 December 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *07/28/2006*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

1. Claims 1-46 are presented for examination.

Claim Objections

2. Claims 1, 4, 7, 10, 14, 15, 24, and 35 are objected to because of the following informalities:

Claims recites the limitation "which can be deformed". It is unclear what the limitation refers. Since a model "which can be deformed" is not a model "which has to be deformed", any arts that does not state "which cannot be deformed" read on the claim limitation.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 4, 7, 10, 12, 26 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 4, 7, and 10 recites the limitation "the readout models" in line 7. There is insufficient antecedent basis for this limitation in the claim.

Claim 12 and 26 recites the limitation "combustion chamber side" in line 5 (Claim 12) and line 3(Claim 26). There is insufficient antecedent basis for this limitation in the claim.

Claim 12 recites the limitation "the piston models" in line 7. There is insufficient antecedent basis for this limitation in the claim because previously there was only one piston model.

Claim Rejections - 35 USC § 101

5. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

6. Claims 1-13, 16-21, and 24-46 are rejected under 35 U.S.C. 101 because they are non-statutory. They are at best computer program software, per se, lacking the necessary hardware to fall into a statutory category of invention.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.

4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

9. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

10. Claims 1-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Barr et al. (The New Digital Engineering Design and Graphics Process), in view of Bracewell et al. (From Embodiment Generation to Virtual Prototyping).

As per claims 1, 14 and 15, Barr et al. teaches a piston design support program, method and apparatus for supporting design of a piston shape of an internal combustion engine (Abstract, Fig. 8-10), said program makes a computer execute:

input step of inputting specification associated with a piston shape (Chapter II, Fig. 1, 8-10);

a read step of reading out, when it is determined in the verification step that the gaps are appropriate, a three-dimensional piston model which can be deformed according to a predetermined rule from a database (Chapter II-III); and

a deformation step of deforming the piston model on the basis of the specification values(Chapter II-III).

Barr et al. fails to teach a verification step of verifying, based on the input specification values, whether or not gaps between the piston and surrounding components thereof are appropriate.

Bracewell et al. teaches a verification step of verifying, based on the input specification values (Parameters, parametric equations, Chapter 3) whether or not gaps between the piston and surrounding components thereof are appropriate (Chapter 3).

Barr et al. and Bracewell et al. are analogous art because they are both related to a solid modeling design system.

Therefore, it would have been obvious to one of ordinary skill in the art of at the time the invention was made to include the verification step of Bracewell et al., in the method of a digital engineering design with 3-D sold modeling system of Barr et al. because a verification step of verifying components value is a well known process in a method of a digital engineering design with 3-D sold modeling system. Bracewell et al. teaches advantages system that provides much greater ease of use, rigour and computational efficiency in design constraint management (Introduction).

As per claim 2, Barr et al. teaches wherein the input step includes a step of inputting specification values associated with a crown shape of the piston and a shape and position of a valve (Chapter II-III).

Barr et al. fails to teach a step of verifying whether or not a gap between the piston and the valve is not less than a predetermined value.

Bracewell et al. teaches a step of verifying whether or not a gap between the piston and the valve is not less than a predetermined value (Chapter 3).

As per claim 3, Barr et al. teaches a two-dimensional data generation step of generating two-dimensional shape data of the piston and the valve on the basis of the specification values (Chapter II-III, Fig. 1); and

Barr et al. fails to teach a calculation step of calculating the gap between piston and the valve using the two-dimensional shape data of the piston and the valve.

Bracewell et al. teaches a calculation step of calculating the gap between piston and the valve using the two-dimensional shape data of the piston and the valve (Chapter 3).

As per claim 4, Barr et al. teaches wherein the two-dimensional data generation step includes a step of generating the two-dimensional data of the piston and the valve by reading out a two-dimensional piston model and valve model, which can be deformed according to a predetermined rule, from the database, and deforming the readout models on the basis of the specification values (Chapter I-VI).

As per claim 5, Barr et al. teaches wherein specification values associated with a skirt shape of the piston and a shape and position of a connecting rod are input (Chapter I-VI).

Barr et al. fails to teach a calculation step of calculating the gap between piston and the valve using the two-dimensional shape data of the piston and the valve.

Bracewell et al. teaches a step of verifying whether or not a gap between the piston and

the connecting rod is not less than a predetermined value (Chapter 3).

As per claim 6, Barr et al. teaches wherein the verification step includes: a two-dimensional data generation step of generating two-dimensional shape data of the piston and the connecting rod on the basis of the specification values (Chapter I-VI).

Barr et al. fails to teach a calculation step of calculating the gap between the piston and the connecting rod using the two-dimensional shape data of the piston and the connecting rod.

Bracewell et al. teaches a calculation step of calculating the gap between the piston and the connecting rod using the two-dimensional shape data of the piston and the connecting rod (Chapter 3).

As per claim 7, Barr et al. teaches a step of generating the two-dimensional data of the piston and the connecting rod by reading out a two-dimensional piston model and connecting rod model, which can be deformed according to a predetermined rule, from the database, and deforming the readout models on the basis of the specification values(Chapter I-VI).

As per claim 8, Barr et al. teaches wherein specification values associated with a skirt shape of the piston and a shape and position of a counter weight are input (Chapter I-VI).

Barr et al. fails to teach a step of verifying whether or not a gap between the piston and the counter weight is not less than a predetermined value.

Bracewell et al. teaches a step of verifying whether or not a gap between the piston and the counter weight is not less than a predetermined value (Chapter 3).

As per claim 9, Barr et al. teaches a two-dimensional data generation step of generating two-dimensional shape data of the piston and the counter weight on the basis of the specification values (Chapter I-VI).

Barr et al. fails to teach a calculation step of calculating the gap between the piston and the counter weight using the two-dimensional shape data of the piston and the counter weight.

Bracewell et al. teaches a calculation step of calculating the gap between the piston and the counter weight using the two-dimensional shape data of the piston and the counter weight (Chapter 3).

As per claim 10, Barr et al. teaches a step of generating the two-dimensional data of the piston and the counter weight by reading out a two-dimensional piston model and counter weight model, which can be deformed according to a predetermined rule, from the database, and deforming the readout models on the basis of the specification values (Chapter I-VI).

As per claim 11, Barr et al. fails to teach a step of reading out a verification formula from the database, substituting the specification values in the verification formula, and verifying whether or not the input specification values are appropriate.

Bracewell et al. teaches a step of reading out a verification formula from the database, substituting the specification values in the verification formula, and verifying whether or not the input specification values are appropriate (Chapter 3).

As per claim 13, Barr et al. teaches a three-dimensional space using the three-dimensional piston model deformed in the deformation step (Chapter I-VI).

Barr et al. fails to teach a determination step of determining whether or not the gap is not less than the predetermined value.

Bracewell et al. teaches a determination step of determining whether or not the gap is not less than the predetermined value (Chapter 3).

As per claims 16, 22 and 23, Barr et al. teaches wherein the input step includes a step of inputting, as the specification values, information associated with the piston, information associated with the valve, information associated with surfaces of a cylinder head that form a combustion chamber, and a target value of a capacity-related value which determines a capacity of the combustion chamber (Chapter I-VIII),

the verification step includes:

a recess model building step of building a recess model (Chapter I-VIII), which opposes the valve and has a gap with the valve to satisfy a predetermined condition, on a top portion of the piston model on the basis of the information associated with the piston and the information associated with the valve input in the input step (Chapter I-VIII),

the deformation step includes:

a piston top portion model building step of setting a shape of a piston top portion so that the capacity of the combustion chamber becomes a target capacity determined from the target value of the capacity-related value (Chapter I-VIII), and

building a three-dimensional piston top portion model (Chapter I-VIII), on the basis of the recess model built in the recess model building step, and the information associated with the piston (Chapter I-VIII), the information associated with the surfaces which form the combustion chamber, and the target value of the capacity-related value input in the input step (Chapter I-VIII), and

said program makes the computer further execute:

a valve model building step of building a three-dimensional valve model on the basis of the information associated with the valve input in the input step (Chapter I-VIII).

Barr et al. fails to teach a gap calculation step of calculating a gap between a recess of the piston top portion model built in the piston top portion model building step and the valve model built in the valve model building step.

Bracewell et al. teaches a gap calculation step of calculating a gap between a recess of the piston top portion model built in the piston top portion model building step and the valve model built in the valve model building step (Chapter 3).

As per claim 17, Barr et al. teaches wherein the recess model building step includes a step of building the recess model on a flat piston top portion (Chapter I-VIII).

As per claim 18, Barr et al. teaches wherein said program makes the computer further execute:

a valve model rebuilding step of rebuilding (Chapter I-VIII), when it is determined in the condition determination step that the gap does not satisfy the predetermined condition, the valve

model by changing at least one of a valve thickness and a slope angle of a chamfer formed at a corner portion as an intersection of a recess opposing surface and side circumferential surface so that the gap satisfies the predetermined condition (Chapter I-VIII).

Barr et al. fails to teach a condition determination step of determining whether or not the gap calculated in the gap calculation step satisfies a predetermined condition of the gap between the recess and the valve in the recess model building step.

Bracewell et al. teaches a condition determination step of determining whether or not the gap calculated in the gap calculation step satisfies a predetermined condition of the gap between the recess and the valve in the recess model building step (Chapter 3).

As per claim 19, Barr et al. teaches wherein when the valve thickness of the valve model rebuilt in the valve rebuilding step is smaller than a prescribed value, said program changes the gap between the recess and the valve in the recess model building step, and makes the computer execute the recess model building step, the piston top portion model building step, the valve model building step, the gap calculation step, and the condition determination step again (Chapter I-VII).

As per claims 20 and 21, Barr et al. teaches inputting information associated with a position and shape of a piston ring groove to be formed on a side circumferential surface of the piston (Chapter I-VII), the deformation step includes:

a piston building step of building a three-dimensional piston model which comprises the recess and the piston ring groove independently of or to include the piston top portion model

built in the piston top portion model building step on the basis of the recess model built in the recess model building step, and the information associated with the piston and the information associated with the position and shape of the piston ring groove input in the input step (Chapter I-VII).

Barr et al. fails to teach a recess thickness calculation step of calculating a minimum value of a thickness between the recess and the piston ring groove in the piston ring on the basis of the piston model built in the piston building step (Claim 21), and is not less than a predetermined value.

Bracewell et al. teaches a recess thickness calculation step of calculating a minimum value of a thickness between the recess and the piston ring groove in the piston ring on the basis of the piston model built in the piston building step (Chapter 3) and (Claim 21) is not less than a predetermined value (Chapter 3).

11. Claims 24-32, 35-43, and 45-46 are rejected under 35 U.S.C. 103(a) as being unpatentable over Barr et al. (The New Digital Engineering Design and Graphics Process).

Barr et al. teaches a piston design support program for supporting design of a piston shape of an internal combustion engine by making a computer execute (Abstract):

an input step of inputting specification values associated with a piston shape (Chapter II, Fig. 1, 8-10);

a read step of reading out a piston model, which can be deformed according to a predetermined rule, from a database (Chapter II-VIII); and

a deformation step of deforming the piston model on the basis of the specification values input in the input step (Chapter II-III), and

the deformation step includes a step of deforming the piston models (Chapter II-VIII).

Barr et al. fails to teach the piston model includes an intake-side piston model which includes an intake-side recess formed to prevent interference with an intake valve, and an exhaust-side piston model which includes an exhaust-side recess formed to prevent interference with an exhaust valve, and both the intake- and exhaust-side piston models and combining the deformed intake- and exhaust-side piston models.

It was known at the time the invention was made that the piston model includes various shape-type models and a collection of parts that mate together to perform a desired function, such as intake- and exhaust-side piston models to prevent interference with an intake valve, and to prevent interference with an exhaust valve, to combine the deformed intake- and exhaust-side piston models. At the time the invention was made, it would have been obvious to one of ordinary skill in the art of technology of a solid modeling system to include the piston model includes an intake-side piston model which includes an intake-side recess formed to prevent interference with an intake valve, and an exhaust-side piston model which includes an exhaust-side recess formed to prevent interference with an exhaust valve, and both the intake- and exhaust-side piston models and combining the deformed intake- and exhaust-side piston models.

The motivation would have been to ensure the low-cost analysis, simulation, and rapid prototyping software of the digital design paradigm (Introduction).

Therefore it would have been obvious to modify Barr et al. to obtain the invention as specified in claim 24.

As per claim 25, Barr et al. teaches a step of combining the piston models, and mirroring the combined model in accordance with the symmetry (Chapter VI), except intake- and exhaust-side piston models.

As per claim 26, Barr et al. teaches the database stores (Chapter II-VI) and the read step includes a step of reading out from the database wherein the specification values (Chapter II-VI), except crown types indicating if a surface of the piston on the combustion chamber side has a convex or recess shape, a plurality of intake-side piston models and a plurality of exhaust-side piston models in correspondence with the crown types, the intake- and exhaust-side piston models corresponding to the crown type input in the input step as the specification value.

As per claim 27, Barr et al. teaches deforming, when dimensions associated with the entire piston are input as the specification values (Chapter II-VI) except both the intake- and exhaust-side piston models.

As per claim 28, Barr et al. teaches a display step of displaying a piston model (Fig. 2-10, Chapter II-VI) except the intake- and exhaust-side piston models in the deformation step while hiding connected surfaces of the intake- and exhaust-side piston models.

As per claim 29, Barr et al. teaches use different shape determination rules upon determining shapes of a recess depth input as the specification value (Chapter II-VIII), except the intake-side recess included in the intake-side piston model and the exhaust-side recess included in the exhaust-side piston model.

As per claim 30, Barr et al. teaches a step of inputting a depth and the shapes and different slopes of bottom surfaces in the input step (Chapter II-VI), except an intake-side recess and an exhaust-side recess.

As per claim 31, Barr et al. teaches a step of inputting a depth and shapes in the input step (Chapter II-VIII), except an intake-side recess depth and an exhaust-side recess depth, and different curvatures of corners formed by bottom surfaces and side for the shapes of the intake- and exhaust-side recesses.

As per claim 32, Barr et al. teaches when depths input in the input step have changed, the shape of the model is determined to change at least one of a slope of a bottom surface and a curvature of a corner formed by the bottom surface and a side surface thereof, but the shape of a recess is determined to change neither of a slope of a bottom surface and a curvature of a corner formed by the bottom surface and a side surface thereof (Chapter II-VIII), except the intake- and exhaust-side recess and the intake-side recess.

As per claim 35, Barr et al. teaches a piston design support program for supporting design of a piston shape of an internal combustion engine by making a computer execute (Abstract, Introduction):

an input step of inputting specification values associated with a piston shape (Fig. 1-10, Chapter II-VIII);

a read step of reading out a piston model, which can be deformed according to a predetermined rule, from a database (Fig. 1-10, Chapter II-VIII); and

a deformation step of deforming the piston model on the basis of the specification values input in the input step (Fig. 1-10, Chapter II-VIII), wherein the database includes, as the piston mode((Fig. 1-10, Chapter II-VIII))l, and

the deformation step includes a step of deforming models ((Fig. 1-10, Chapter II-VIII)).

Barr et al. fails to teach a main body model which represents a shape of a surface of the piston on the combustion chamber side, a space model which represents a space shape to be shaved from the main body model, and both the main body model and the space model in accordance with the specification values, and shaving the main body model into a shape expressed by the space model.

It was known at the time the invention was made that the piston model includes various shape-type models and a collection of parts that mate together to perform a desired function, such as a main body model which represents a shape of a surface of the piston on the combustion chamber side, a space model which represents a space shape to be shaved from the main body model, and both the main body model and the space model in accordance with the specification values, and shaving the main body model into a shape expressed by the space model. At the

time the invention was made, it would have been obvious to one of ordinary skill in the art of technology of a solid modeling system to include the piston model includes a main body model which represents a shape of a surface of the piston on the combustion chamber side, a space model which represents a space shape to be shaved from the main body model, and both the main body model and the space model in accordance with the specification values, and shaving the main body model into a shape expressed by the space model.

The motivation would have been to ensure the low-cost analysis, simulation, and rapid prototyping software of the digital design paradigm (Introduction).

Therefore it would have been obvious to modify Barr et al. to obtain the invention as specified in claim 35.

As per claim 36, Barr et al. teaches a shape of the piston (Fig. 1-10, Chapter II-VIII), except a skirt inner space model which represents a shape inside a skirt of the piston.

As per claim 37, Barr et al. teaches a shape of the position (Fig. 1-10, Chapter II-VIII), except a skirt outer space model which represents a shape of a skirt outer surface of the piston.

As per claim 38, Barr et al. teaches a pin hole space model which represents a shape of a pin hole that receives a pin used to hold a connecting rod (Fig. 1-10, Chapter II-VIII).

As per claim 39, Barr et al. teaches a step of inputting dimensions of the entire piston as the specification values, and the deformation step includes a step of deforming the piston (Chapter

II-VIII), except the main body model and the space model in accordance with the dimensions of the entire piston, and shaving the space model from the main body model.

As per claim 40, Barr et al. teaches a step of inputting a thickness of the piston as the specification value, and the deformation step includes a step of shaving the piston model (Fig. 1-10, Chapter II-VIII), except skirt inner space model from the main body model while laying out the skirt inner space model at a position separated from the main body model by a distance corresponding to the thickness input in the input step.

As per claim 41, a step of inputting dimensions and a minimum thickness of the piston as the specification values, the deformation step includes a step of producing error information or performing re-deformation and shaving a piston model(Fig. 1-10, Chapter II-VIII), except a shape of the skirt inner space model, the skirt inner space model, and the skirt inner space model from the main body model becomes not more than the minimum thickness.

As per claim 42, Barr et al. teaches a piston model, and the deformation step includes a step of deforming the models (Fig. 1-10, Chapter II-VIII), except an intake-side piston model which includes an intake-side recess formed to prevent interference with an intake valve, and an exhaust-side piston model which includes an exhaust-side recess formed to prevent interference with an exhaust valve, both the intake- and exhaust-side piston models and combining the deformed intake- and exhaust-side piston models.

As per claim 43, Barr et al. teaches a step of combining the piston models, and mirroring the combined model in accordance with the symmetry (Chapter VI), except intake- and exhaust-side piston models.

As per claim 45, Barr et al. teaches a step of inputting a pin boss gap as the specification value and the deformation step (Fig. 1-10, Chapter II-VIII), except the skirt inner space model includes a portion that represents a space shape of a crown back surface, and increasing a curvature of the crown back surface of the skirt inner space model with decreasing pin boss gap input in the input step.

As per claim 46, Barr et al. teaches a step of inputting a skirt inner diameter as the specification value, and the deformation step (Fig. 1-10, Chapter II-VIII), except the skirt inner space model includes a portion that represents a space shape of a crown back surface, increasing a curvature of the crown back surface of the skirt inner space model with decreasing skirt inner diameter input in the input step.

12. Claims 33, 34, and 44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Barr et al. (The New Digital Engineering Design and Graphics Process).

Barr et al. teaches most all of the instant invention as applied to claims 24-32, 35-43, and 45-46 above.

As per claims 33 and 34, Barr et al. teaches (Claims 33 and 44) a step of inputting the specification value and a step of deforming the piston model (Fig. 1-10, Chapter II-VIII), and

(Claim 34) a piston shape is determined by repeating the deformation step and the compression ratio calculation step a piston shape and deformation step (Fig. 1-10, Chapter II-VIII).

Barr et al. fails to teach (Claims 33, 34, and 44) a target compression ratio, and

(Claim 44) the skirt inner space model includes a portion that represents a space shape of a crown back surface, and a curvature of the crown back surface of the skirt inner space model with increasing target compression ratio input in the input step.

Official notice is taken that use of a target compression ratio is a well known process at the time the invention was made in the analogous art of a solid model design.

Therefore, it would have been obvious to modify the teaching of Barr et al. to include the well known features such as the use of a target compression ratio because it provides the low-cost analysis, simulation, and rapid prototyping software of the digital design paradigm (Introduction).

Further, as per claim 44, it was known at the time the invention was made that the piston model includes various shape-type models and a collection of parts that mate together to perform a desired function, such as the skirt inner space model includes a portion that represents a space shape of a crown back surface, and a curvature of the crown back surface of the skirt inner space model with increasing target compression ratio input in the input step. At the time the invention was made, it would have been obvious to one of ordinary skill in the art of technology of a solid modeling system to include the piston model includes the skirt inner space model

includes a portion that represents a space shape of a crown back surface, and a curvature of the crown back surface of the skirt inner space model with increasing target compression ratio input in the input step.

The motivation would have been to ensure the low-cost analysis, simulation, and rapid prototyping software of the digital design paradigm (Introduction).

Therefore it would have been obvious to modify Barr et al. to obtain the invention as specified in claim 44.

Conclusion

13. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Higuchi et al. (U.S. Patent No 5945995) discloses CAD system which automatically creates a 30dimensional solid dimensional drawing.

Kikuchi et al. (U.S. Patent No 5341461) discloses a method of rendering a two dimensional drawing into a three dimensional drawing using a CAD program.

Zuffante et al. (U.S. Patent No 6219049) mate inferencing.

Haberman discloses creating parametric models using ANSYS (Creating Parametric Models using ANSYS).

Watanabe et al. (US Patent No. 5701403) discloses CAD system.

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eun H. Chung whose telephone number is 571-272-2164. The examiner can normally be reached on 8:30am-5:00pm Monday to Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul Rodriguez can be reached on 571-272-3753. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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EHC

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